cited art.

Claim 5090 describes a combination of features including: "wherein the pressure is controlled such that pressure proximate to one or more of the heaters is greater than a pressure proximate to a location where the fluid is produced." The above quoted feature of claim 5090, in combination with the other features of the claim, does not appear to be taught or suggested by the cited art.

S. Prior Art Made of Record

In the Office Action, the Examiner states "It is noted that the reference to Bridges et al (4,144,935) also heats a subterranean formation to effect hydrocarbon fluids production, which heating also fractures or increases the formation permeability (note col. 17, lines 15-45). Thus, it is deemed cumulative to the references applied above against one or more of the claims, such as 2193, 2232 or 5081." Applicant respectfully disagrees. Applicant submits that Bridges does not appear to at least teach providing heat from one or more heaters to at least a portion of the formation and allowing the heat to transfer from one or more heaters to a part of the formation. Applicant submits that the cited art does not appear to teach or suggest the combination of features of claims 2193, 2232, or 5081 and the claims dependent thereon.

T. Conclusion

Applicant submits that all claims are in condition for allowance. Favorable reconsideration is respectfully requested.

Applicant hereby requests a one-month extension of time to respond to the office action mailed July 9, 2002. A Fee Authorization in the amount of $722.00 is enclosed to cover fees for additional claims, the one month extension of time, and for consideration of an Information Disclosure Statement. If any further extension of time is required, Applicant hereby requests the appropriate extension of time. If any fees have been omitted, or if any fees have been overpaid,

please appropriately charge or credit those fees to Conley, Rose & Tayon, P.C. Deposit Account Number 50-1505/5659-06000/EBM.

Respectfully submitted,

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Date: 11/12/02

Marked-Up Copy of the Amendments Submitted in Response to the Office Action Mailed on July 9, 2002

In the Specification:

On page 30, the paragraph beginning on line 1:

"Hydrocarbons" are generally defined as molecules formed primarily by carbon and hydrogen atoms~~organic material that contains carbon and hydrogen in their molecular structures~~. Hydrocarbons may also include other elements, such as, but not limited to, halogens, metallic elements, nitrogen, oxygen, and/or sulfur.

On page 53, the paragraph beginning on line 20:

As shown in FIG. 3, in addition to heat sources 100, one or more production wells ~~102~~ 104 will typically be disposed within the portion of the coal formation. Formation fluids may be produced through production well 104. ~~Production well 102 may be configured such that a mixture that may include formation fluids may be produced through the production well.~~ Production well ~~102~~ 104 may also include a heat source. In this manner, the formation fluids may be maintained at a selected temperature throughout production, thereby allowing more or all of the formation fluids to be produced as vapors. Therefore high temperature pumping of liquids from the production well may be reduced or substantially eliminated, which in turn decreases production costs. Providing heating at or through the production well tends to: (1) ~~prevent~~ inhibit condensation and/or refluxing of production fluid when such production fluid is moving in the production well proximate to the overburden, (2) increase heat input into the formation, and/or (3) increase formation permeability at or proximate the production well.

In the Claims:

2193. (amended) A method of treating a coal formation in situ, comprising:

providing heat from one or more ~~heat source~~heaters to at least a portion of the formation; and

allowing the heat to transfer from ~~the~~ one or more ~~heat source~~heaters to a ~~selected section~~part of the formation such that a permeability of at least a portion of the ~~selected section~~part of the formation increases to greater than about 100 millidarcy.

2194. (amended) The method of claim 2193, wherein the one or more ~~heat source~~heaters comprise at least two ~~heat source~~heaters, and wherein superposition of heat from at least ~~the~~ two ~~heat source~~heaters pyrolyzes at least some hydrocarbons within the ~~selected section~~part of the formation.

2195. (amended) The method of claim 2193, further comprising maintaining a temperature within the ~~selected section~~part of the formation within a pyrolysis temperature range.

2196. (amended) The method of claim 2193, wherein at least one of the ~~one or more heat source~~heaters comprises an electrical heater~~s~~.

2197. (amended) The method of claim 2193, wherein at least one of the ~~one or more heat sources~~heaters comprises a surface burner~~s~~.

2198. (amended) The method of claim 2193, wherein at least one of the ~~one or more heat sources~~ heaters comprises a flameless distributed combustor~~s~~.

2199. (amended) The method of claim 2193, wherein at least one of the ~~one or more heat sources~~heaters comprises a natural distributed combustor~~s~~.

2200. (amended) The method of claim 2193, further comprising controlling a pressure and a temperature within at least a majority of the partselected section of the formation, wherein the pressure is controlled as a function of temperature, or the temperature is controlled as a function of pressure.

2201. (amended) The method of claim 2193, further comprising controlling the heat such that an average heating rate of the selected sectionpart of the formation is less than about 1 °C per day during pyrolysis.

2202. (amended) The method of claim 2193, wherein providing heat from the one or more heat sourceof the heaters to at least the portion of formation comprises:

heating a selected volume (V) of the coal formation from the one or more heat sourceof the heaters, wherein the formation has an average heat capacity (C_v), and wherein the heating pyrolyzes at least some hydrocarbons within the selected volume of the formation; and

wherein heating energy/day (Pwr) provided to the selected volume is equal to or less than $h*V*C_v*\rho_B$, wherein ρ_B is formation bulk density, and wherein an average heating rate (h) of the selected volume is about 10 °C/daywherein heating energy/day provided to the volume is equal to or less than Pwr, wherein Pwr is calculated by the equation:

$Pwr = h*V*C_v*\rho_B$

wherein Pwr is the heating energy/day, h is an average heating rate of the formation, ρ_B is formation bulk density, and wherein the heating rate is less than about 10 °C/day.

2204. (amended) The method of claim 2193, wherein providing heat from the one or more heat sourceof the heaters comprises heating the selected sectionpart of the formation such that a thermal conductivity of at least a portion of the selected sectionpart of the formation is greater than about 0.5 W/(m °C).

2219. (amended) The method of claim 2193, further comprising controlling a pressure within at least a majority of the part~~selected section~~ of the formation, wherein the controlled pressure is at least about 2.0 bar absolute.

2224. (amended) The method of claim 2193, further comprising:

providing hydrogen (H_2) to the heated part~~section~~ to hydrogenate hydrocarbons within the ~~section~~part; and

heating a portion of the ~~section~~part with heat from hydrogenation.

2226. (amended) The method of claim 2193, further comprising increasing a permeability of a majority of the ~~selected section~~part of the formation to greater than about 5 Darcy.

2227. (amended) The method of claim 2193, wherein allowing the heat to transfer comprises ~~substantially uniformly~~ increasing a permeability of a majority of the ~~selected section~~part of the formation such that the permeability of the part is substantially uniform.

2229. (amended) The method of claim 2193, further comprising producing a mixture in a production well, wherein at least about 7 ~~heat source~~heaters are disposed in the formation for each production well.

2230. (amended) The method of claim 2193, further comprising providing heat from three or more ~~heat source~~heaters to at least a portion of the formation, wherein three or more of the ~~heat source~~heaters are located in the formation in a unit of ~~heat source~~heaters, and wherein the unit of ~~heat source~~heaters comprises a triangular pattern.

2231. (amended) The method of claim 2193, further comprising providing heat from three or more ~~heat source~~heaters to at least a portion of the formation, wherein three or more of the ~~heat source~~heaters are located in the formation in a unit of ~~heat source~~heaters, wherein the unit of ~~heat source~~heaters comprises a triangular pattern, and wherein a

plurality of the units are repeated over an area of the formation to form a repetitive pattern of units.

2232. (amended) A method of treating a coal formation in situ, comprising:

providing heat from one or more ~~heat source~~heaters to at least a portion of the formation; and

allowing the heat to transfer from ~~the~~ one or more ~~heat source~~heaters to a part~~selected section~~ of the formation ~~such that~~to increase a permeability of a majority of at least a portion of the ~~selected section~~part of the formation ~~increases~~ such that the permeability of the majority of the part is substantially uniform~~ly~~.

2233. (amended) The method of claim 2232, wherein the one or more ~~heat source~~heaters comprise at least two ~~heat source~~heaters, and wherein superposition of heat from at least ~~the~~ two ~~heat source~~heaters pyrolyzes at least some hydrocarbons within the part~~selected section~~ of the formation.

2234. (amended) The method of claim 2232, further comprising maintaining a temperature within the ~~selected section~~part of the formation within a pyrolysis temperature range.

2235. (amended) The method of claim 2232, wherein at least one of the ~~one or more heat sources~~heaters comprises an electrical heater~~s~~.

2236. (amended) The method of claim 2232, wherein at least one of the ~~one or more heat sources~~heaters comprises a surface burner~~s~~.

2237. (amended) The method of claim 2232, wherein at least one of the ~~one or more heat sources~~heaters comprises a flameless distributed combustor~~s~~.

2238. (amended) The method of claim 2232, wherein at least one of the ~~one or more heat sources~~heaters comprises a natural distributed combustor~~s~~.

2239. (amended) The method of claim 2232, further comprising controlling a pressure and a temperature within at least a majority of the partselected section of the formation, wherein the pressure is controlled as a function of temperature, or the temperature is controlled as a function of pressure.

2240. (amended) The method of claim 2232, further comprising controlling the heat such that an average heating rate of the selected sectionpart of the formation is less than about 1 °C per day during pyrolysis.

2241. (amended) The method of claim 2232, wherein providing heat from the one or more heat sourceof the heaters to at least the portion of formation comprises:

heating a selected volume (V) of the coal formation from the one or more heat sourceof the heaters, wherein the formation has an average heat capacity (C_v), and wherein the heating pyrolyzes at least some hydrocarbons within the selected volume of the formation; and

wherein heating energy/day (Pwr) provided to the selected volume is equal to or less than $h*V*C_v*\rho_B$, wherein ρ_B is formation bulk density, and wherein an average heating rate (h) of the selected volume is about 10 °C/daywherein heating energy/day provided to the volume is equal to or less than Pwr, wherein Pwr is calculated by the equation:

$Pwr = h*V*C_v*\rho_B$

wherein Pwr is the heating energy/day, h is an average heating rate of the formation, ρ_B is formation bulk density, and wherein the heating rate is less than about 10 °C/day.

2243. (amended) The method of claim 2232, wherein providing heat from the one or more of the heat sourceheaters comprises heating the selected sectionpart of the formation such that a thermal conductivity of at least a portion of the selected sectionpart of the formation is greater than about 0.5 W/(m °C).

2258. (amended) The method of claim 2232, further comprising controlling a pressure within at least a majority of the part~~selected section~~ of the formation, wherein the controlled pressure is at least about 2.0 bar absolute.

2263. (amended) The method of claim 2232, further comprising:

providing hydrogen (H_2) to the heated ~~section~~part to hydrogenate hydrocarbons within the ~~section~~part; and

heating a portion of the ~~section~~part with heat from hydrogenation.

2265. (amended) The method of claim 2232, wherein allowing the heat to transfer comprises increasing a permeability of a majority of the ~~selected section~~part of the formation to greater than about 100 millidarcy.

2267. (amended) The method of claim 2232, further comprising producing a mixture in a production well, wherein at least about 7 ~~heat source~~heaters are disposed in the formation for each production well.

2268. (amended) The method of claim 2232, further comprising providing heat from three or more ~~heat source~~heaters to at least a portion of the formation, wherein three or more of the ~~heat source~~heaters are located in the formation in a unit of ~~heat source~~heaters, and wherein the unit of ~~heat source~~heaters comprises a triangular pattern.

2269. (amended) The method of claim 2232, further comprising providing heat from three or more ~~heat source~~heaters to at least a portion of the formation, wherein three or more of the ~~heat source~~heaters are located in the formation in a unit of ~~heat source~~heaters, wherein the unit of ~~heat source~~heaters comprises a triangular pattern, and wherein a plurality of the units are repeated over an area of the formation to form a repetitive pattern of units.

5081. (amended) A method for treating hydrocarbons in at least a portion of a coal formation, wherein the portion has an average permeability of less than about 10

millidarcy, comprising:

providing heat from one or more ~~heat source~~heaters to the formation;

allowing the heat to transfer from ~~the~~ one or more ~~heat source~~heaters to a part~~selected section~~ of the formation such that heat from the ~~heat source~~heaters pyrolyzes at least some hydrocarbons within the ~~selected section~~part of the formation, and wherein heat from the ~~heat source~~heaters increases the permeability of at least a portion of the ~~selected section~~part of the formation; and

producing a mixture comprising hydrocarbons from the formation.

5082. (amended) The method of claim 5081, wherein the one or more ~~heat source~~heaters comprise at least two ~~heat source~~heaters, and wherein superposition of heat from at least ~~the~~ two ~~heat source~~heaters pyrolyzes at least some hydrocarbons within the part~~selected section~~ of the formation, and wherein superposition of heat from at least ~~the~~ two ~~heat source~~heaters increases the permeability of at least the portion of the ~~selected section~~part of the formation.

5083. (amended) The method of claim 5081, further comprising allowing heat to transfer from at least one of ~~the~~ one or more of the ~~heat source~~heaters to the ~~selected section~~part of the formation to create thermal fractures in the formation wherein the thermal fractures substantially increase the permeability of the ~~selected section~~part of the formation.

5084. (amended) The method of claim 5081, wherein the heat is provided such that an average temperature in the ~~selected section~~part of the formation ranges from approximately about 270 °C to about 400 °C.

5085. (amended) The method of claim 5081, wherein at least one of the ~~one or more heat source~~heaters comprises an electrical heater located in the formation.

5086. (amended) The method of claim 5081, wherein at least one of the ~~one or more heat source~~heaters is located in a heater well, and wherein at least one of the heater wells

comprises a conduit located in the formation, and further comprising heating the conduit by flowing a hot fluid through the conduit.

5087. (amended) The method of claim 5081, wherein at least some of the ~~heat source~~heaters are arranged in a triangular pattern.

5090. (amended) The method of claim 5088, wherein the pressure is controlled such that pressure proximate to ~~the~~ one or more of the ~~heat source~~heaters is greater than a pressure proximate to a location where the fluid is produced.

5150. (amended) A method of treating a coal formation in situ, comprising:

providing heat from one or more ~~heat source~~heaters to at least a portion of the formation;

allowing the heat to transfer from ~~the~~ one or more ~~heat source~~heaters to a part~~selected section~~ of the formation such that a permeability of at least a portion of the ~~selected section~~part of the formation increases, and is greater than about 100 millidarcy; and

controlling formation conditions to produce a mixture from the formation, wherein a partial pressure of H_2 within the mixture is greater than about 0.5 bars absolute.

5151. (amended) The method of claim 5150, wherein the one or more ~~heat source~~heaters comprise at least two ~~heat source~~heaters, and wherein superposition of heat from at least ~~the~~ two ~~heat source~~heaters pyrolyzes at least some hydrocarbons within the part~~selected section~~ of the formation.

5152. (amended) The method of claim 5150, further comprising maintaining a temperature within the ~~selected section~~part of the formation within a pyrolysis temperature range.

5153. (amended) The method of claim 5150, further comprising controlling a pressure and a temperature within at least a majority of the part~~selected section~~ of the formation,

wherein the pressure is controlled as a function of temperature, or the temperature is controlled as a function of pressure.

5154. (amended) The method of claim 5150, further comprising controlling the heat such that an average heating rate of the ~~selected section~~part of the formation is less than about 1 °C per day during pyrolysis.

5156. (amended) The method of claim 5150, wherein providing heat from ~~the~~ one or more of the ~~heat source~~heaters comprises heating the ~~selected section~~part of the formation such that a thermal conductivity of at least a portion of the ~~selected section~~part of the formation is greater than about 0.5 W/(m °C).

5169. (amended) The method of claim 5150, further comprising controlling a pressure within at least a majority of the part~~selected section~~ of the formation, wherein the controlled pressure is at least about 2.0 bar absolute.

5172. (amended) The method of claim 5150, wherein allowing the heat to transfer comprises ~~substantially uniformly~~ increasing a permeability of a majority of the ~~selected section~~part of the formation such that the permeability of the majority of the part is substantially uniform.

5174. (amended) The method of claim 5150, further comprising producing a mixture in a production well, wherein at least about 7 ~~heat source~~heaters are disposed in the formation for each production well.

5175. (amended) A method of treating a coal formation in situ, comprising:

providing heat from one or more ~~heat source~~heaters to at least a portion of the formation;

allowing the heat to transfer from ~~the~~ one or more ~~heat source~~heaters to a part~~selected section~~ of the formation such that a permeability of at least a portion of the ~~selected section~~part of the formation increases, and is greater than about 100 millidarcy;

and

producing a mixture from the formation, wherein the produced mixture comprises non-condensable hydrocarbons, and wherein a molar ratio of ethene to ethane in the non-condensable hydrocarbons ranges from about 0.001 to about 0.15.

5176. (amended) The method of claim 5175, wherein the one or more ~~heat source~~heaters comprise at least two ~~heat source~~heaters, and wherein superposition of heat from at least the two ~~heat source~~heaters pyrolyzes at least some hydrocarbons within the part~~selected section~~ of the formation.

5177. (amended) The method of claim 5175, further comprising maintaining a temperature within the ~~selected section~~part of the formation within a pyrolysis temperature range.

5178. (amended) The method of claim 5175, further comprising controlling a pressure and a temperature within at least a majority of the part~~selected section~~ of the formation, wherein the pressure is controlled as a function of temperature, or the temperature is controlled as a function of pressure.

5179. (amended) The method of claim 5175, further comprising controlling the heat such that an average heating rate of the ~~selected section~~part of the formation is less than about 1 °C per day during pyrolysis.

5181. (amended) The method of claim 5175, wherein providing heat from ~~the~~ one or more of the ~~heat source~~heaters comprises heating the ~~selected section~~part of the formation such that a thermal conductivity of at least a portion of the ~~selected section~~part of the formation is greater than about 0.5 W/(m °C).

5193. (amended) The method of claim 5175, further comprising controlling a pressure within at least a majority of the part~~selected section~~ of the formation, wherein the controlled pressure is at least about 2.0 bar absolute.

5196. (amended) The method of claim 5175, wherein allowing the heat to transfer comprises ~~substantially uniformly~~ increasing a permeability of a majority of the ~~selected section~~part of the formation such that the permeability of the majority of the part is substantially uniform.

5198. (amended) The method of claim 5175, further comprising producing a mixture in a production well, wherein at least about 7 ~~heat source~~heaters are disposed in the formation for each production well.